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PATENT SPECIFICATION (11) 1 476 351

(21) Application No. 16803/74 (22) Filed 17 April 1974

(23) Complete Specification filed 11 April 1975

(44) Complete Specification published 10 June 1977

(51) INT CL² A61K 31/16; A23L 2/02; A24B 15/00; A61C 15/00; A61K 7/06, 7/027, 7/035; C11D 3/26 // C09K 3/30

(52) Index at acceptance

A5B 333 334 33Y 380 38Y 390 392 401 402 40Y 410 411 41Y 421 422 42Y 433 43Y 461 462 46Y 493 49Y 530 53Y 541 544 54Y 564 565 566 567 56Y 595 596 597 59Y 646 64Y 664 666 66Y 674 67Y 771 772 774 77Y

A2B 15 6A

A2C 20CX 20HX

C4X 11

C5D 6B10A 6B10C 6B11A 6B12B1 6B12B3 6B12E 6B12F1 6B12F2 6B2 6B4 6B6 6C2 6C4 6C8

C6E 6D

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(54) IMPROVEMENTS IN AND RELATING TO COMPOUNDS HAVING A PHYSIOLOGICAL COOLING EFFECT AND COMPOSITIONS CONTAINING THEM

(71) We, WILKINSON SWORD LIMITED, a British Company, of Sword House, High Wycombe, Buckinghamshire, de hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to compositions and compounds having a physiological cooling effect on the skin and on the mucous membranes of the body, particularly those of the mouth, nose, throat and gastrointestinal tract.

Menthol is well known for its physiological cooling effect on the skin and mucous membranes of the mouth and has been extensively used as a flavouring agent (mentrol being a major constituent of oil of peppermint) in foodstuffs, beverages, dentifrices and mouthwashes and as a component in a wide range of toiletries, liniments and lotions for topical application. Menthol is also a well known tobacco additive for producing a 'cool' sensation in the mouth when smoking.

It is well established that the 'cooling' effect of menthol is a physiological effect due to the direct action of menthol on the nerve endings of the human body responsible for the detection of hot and cold and is not due to latent heat of evaporation. It is believed that the menthol acts as a direct stimulus on the cold receptors at the nerve endings which in turn stimulate the central nervous system.

Although menthol is well established as a physiological coolant its use, in some compositions, is circumscribed by its strong minty odour and its relative volatility.

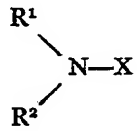
A few other compounds have been reported in the technical literature as having an odour or flavour similar to menthol and from time to time have been proposed as flavourants or odourants in a variety of topical and ingestible compositions. For example, Japanese Patent Publication No. 39—19627 reports that 3-hydroxymethyl p-menthane (menthyl carbinol) has a flavour closely resembling that of l-menthol and suggests its use as a flavourant in confectionery, chewing gum, and tobacco. In Swiss Patent No. 484,032 certain saccharide esters of menthol are proposed as additives to tobacco. In French Patent Specification No. 1,572,332 N,N-dimethyl 2-ethylbutanamide is reported as having a minty odour and refreshing effect, and the minty odour of N,N-diethyl 2,2-dimethylpropanamide is also referred to. A similar effect is reported for N,N-diethyl 2-ethylbutanamide in Berichte *39*, 1223, (1906). A minty odour has also been reported for 2,4,6-trimethylheptan-4-ol and 2,4,6-trimethyl hept-2-en-4-ol in Parfums-Cosmetiques-Savons, May 1956, pp. 17—20. The cooling effect of menthol and other related terpene alcohols and their derivatives has also been studied and reported in Koryo, 95, (1970) pp. 39—43. 2,3-p-menthane diol has also been reported as having a sharp cooling taste (Beilstein, handbuch der Organischen Chemie, 4th Ed. (1923) vol. 6, p.744). Still other compounds having a physiological cooling effect are

disclosed in our UK Patents Nos. 1,353,381, 1,315,626, 1,315,625, 1,351,761, 1,404,596, 1,411,785, 1,421,743, 1,411,786 and 1,422,998.

Despite this knowledge of other compounds having an odour and flavour similar to that of menthol, menthol is still extensively used in topical, ingestible and other compositions notwithstanding the disadvantages mentioned above, namely its very strong odour and its relative volatility, and despite its high cost.

The present invention is based on the discovery of a group of cyclic and acyclic amides, substituted ureas and sulphonamides which have a pronounced physiological cooling activity, but which are without the strong minty smell of menthol, and which are inexpensive and easily synthesised from readily available starting materials.

The compounds discovered in accordance with this invention may be represented by the formula:

I 

where R_1, when taken separately, is H, C_1—C_7 alkyl or C_3—C_6 cycloalkyl;

R_2, when taken separately, is C_3—C_8 alkyl or C_3—C_8 alkylcycloalkyl, alkylcycloalkylalkyl, cycloalkyl, or cycloalkylalkyl, with the proviso that R_2 is branched at an alpha carbon atom relative to the N atom when R_1 is H or at an alpha or beta carbon atom when R_1 is alkyl or cycloalkyl, this condition to be satisfied, in the case of cyclic groups, when the carbon atom alpha or beta to the N atom is part of the cycle;

R_1 and R_2, when taken together, represent a straight or branched chain alkylene group forming with the N atom to which they are attached a 5—10 membered heterocycle, and preferably having branching at an alpha and beta carbon atom relative to the N atom;

R_1 and R_2 when separate groups and when taken together provide a total of at least 5 carbon atoms; and

X represents R_3CO—, R_4SO_2— or R_5R_6NCO—,

where:

R_3 is H, C_1—C_6 cycloalkyl, C_2—C_8 hydroxyalkyl, C_2—C_8 carboxyalkyl or C_3—C_8 alkylcarboxyalkyl, with the proviso that when R_3 is C_6 alkyl it is primary in structure;

R_4 is C_1—C_6 alkyl or C_3—C_6 cycloalkyl, with the proviso that when R_4 is C_5 or C_6 alkyl it is primary in structure;

R_5 and R_6, when taken separately, are each H, C_1—C_6 alkyl, C_3—C_6 alkylcycloalkyl, cycloalkyl, or cycloalkylalkyl, C_2—C_8 hydroxyalkyl, C_2—C_8 carboxyalkyl or C_3—C_8 alkylcarboxyalkyl; or together represent a straight or branched chain C_3—C_{10} alkylene group optionally containing an ether oxygen atom; and

where:

R_1, R_2 and X provide a total of from 7—16 carbon atoms.

In accordance with this invention, therefore, there are provided consumer products for application to or consumption by the human body into which there is incorporated a means for stimulating the cold receptors of the nervous system of the human body wherein said means comprise an effective amount of a compound of the formula hereinbefore set forth.

By consumer products we mean a manufactured product applied to or consumed by the human person for toilet, cosmetic, hygienic, nutritive, curative, prophylactic, or other purposes and constituting a vehicle by means of which the said compounds may be brought into contact with the skin, mucous membranes or other surface tissues of the body, whether external tissues or internal, for example, of the nose, throat, mouth and gastrointestinal tract, and includes liquid and solid phase preparations of an essentially formless nature e.g. solutions, emulsions, pastes, ointments and powders, solid phase preparations of semi-permanent form, e.g. shaped toilet and cosmetic preparations and shaped edible preparations, whose shaped form is only temporary and which lose that form on use, and articles of permanent form but which are of an essentially disposable nature, e.g. cleansing tissues and toothpicks.

For the avoidance of doubt, the term 'consumer product' does not extend to liquids and mixtures of liquids which merely act as a solvent for the physiologically active compound.

Typical consumer products into which the compounds of this invention may be incorporated and which may therefore serve as vehicles for application of the compounds to the person are:

1. Edible and potable compositions including alcoholic and non-alcoholic beverages; confectionery, chewing gum, cachous; ice cream; jellies;

2. Toiletries including after-shave lotions, shaving soaps, creams and foams, toilet water, deodorants and antiperspirants, "solid colognes", toilet soaps, bath oils and salts, shampoos, hair oils, talcum powders, face creams, hand creams, sunburn lotions, cleansing tissues, dentifrices, toothpicks, mouthwashes, hair tonics, eyedrops.

3. Medicaments including antiseptic ointments, pile ointments, liniments, lotions, decongestants, counter-irritants, cough mixtures, throat lozenges, antacid and indigestion preparations, and analgesics;

4. Miscellaneous compositions such as water soluble adhesive compositions for envelopes, postage stamps and adhesive labels.

5. Tobacco and tobacco-containing preparations, e.g. cigarettes, pipe tobacco, chewing tobacco, snuff, and cigars.

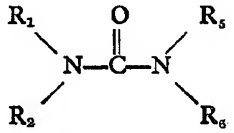
Detailed Description.

The compounds of formula I useful as cold receptor stimulants in accordance with this invention fall into three classes: cyclic and acyclic amides, i.e. compounds of formula I, where X is R_3CO—,; substituted ureas, i.e. compounds of formula I where X is R_5R_6NCO—; and sulphonamides, i.e. compounds of formula I where X is R_4SO_2—. Of the three classes, the substituted ureas and the cyclic and acyclic amides are much to be preferred over the sulphonamides by reason of generally higher levels of physiological cooling activity, greater stability and cheaper manufacture. By reason of high levels of activity and cheapness, the substituted ureas are generally to be preferred over the cyclic and acyclic amides. The three classes of active compound will be discussed separately.

Substituted Ureas.

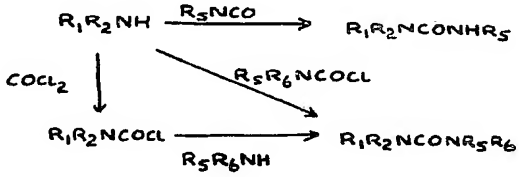
Broadly speaking the compounds of highest activity are the substituted ureas which may be represented by the formula II:

II



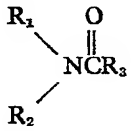
where R_1, R_2, R_5 and R_6 are as defined above. Preferred substituted ureas are those compounds where R_1 is H or C_1—C_7 alkyl, R_2 is C_3—C_8 alkyl or C_3—C_8 cycloalkyl, cycloalkylalkyl or alkylcycloalkyl, R_2 having branching in an alpha position relative to the N atom when R_1 is H, or at an alpha or beta position when R_1 is alkyl, or where R_1 and R_2 are joined to form an alkylene group having up to 10 carbon atoms and having branching at an alpha or beta position relative to the N atom, and forming together with the nitrogen atom a 5- to 7-membered ring; and where R_5 is H or C_1—C_6 alkyl and R_6 is C_1—C_6 alkyl, or C_3—C_6 cycloalkyl, or where R_5 and R_6 jointly represent an alkylene group, optionally containing an ether oxygen atom and forming with the N atom a 5- or 6-membered ring.

The substituted ureas of formula II may be easily prepared by reaction of an appropriate amine with an isocyanate or carbamoyl chloride, the following being a typical reaction scheme:



Cyclic and Acyclic Amides.

The cyclic and acyclic amides useful in this invention may be represented by formula III:

III 

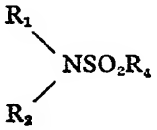
where R_1, R_2 and R_3 are as defined above in connection with formula I. Preferred values for R_1 and R_2 are as set out above for formula II and the preferred values for R_3 are H, C_1—C_6 alkyl, C_2—C_6 hydroxyalkyl, carboxyalkyl or alkylcarboxyalkyl and C_3—C_6 cycloalkyl.

The amides may readily be prepared by reaction of the appropriate acid chloride and a substituted amine in accordance with procedures well known for the preparation of amides e.g.

$$R_1R_2NH + R_3COCl \rightarrow R_1R_2NCOR_3 + HCl$$

Cyclic and Acyclic Sulphonamides.

Although less preferred than the substituted ureas and amides hereinbefore described, but nevertheless still possessing utility in the compositions of this invention, are sulphonamides of formula IV:

IV 

where R_1, R_2 and R_4 are as above defined in connection with formula I. Preferred values of R_1 and R_2 are as defined above in connection with formula II, whilst the preferred values for R_4 are C_1—C_4 alkyl.

The sulphonamides of formula IV may readily be prepared from the corresponding sulfonyl chloride and substituted amine by procedures well known in the art e.g.

$$R_1R_2NH + R_5SO_2Cl \rightarrow R_1R_2NSO_2R_5 + HCl$$

As will be apparent from the above formulae some of the compounds used as cold receptor stimulants in accordance with this invention exhibit either geometric or optical isomerism or both and, depending on the starting materials and the methods used in their preparation the compounds may be isomerically pure, i.e. consisting of one geometric or optical isomer, or they may be isomeric mixtures, both in the geometric and optical sense. Generally, the compounds will be used as isomeric mixtures, but in some cases the cooling effect may differ as between geometric and optical isomers, and therefore one or other isomer may be preferred.

For the purposes of the present disclosure the following test procedure has been devised as a means to identify compounds having a physiological cooling activity in accordance with the present invention and herein referred to as cold receptor stimulants. This test is intended purely as a means for identifying compounds having a physiological cooling activity and useful in the present invention and for giving an indication of the different relative activities of the compounds, as between themselves and as compared with menthol, when applied in a particular manner to a particular part of the body. The results are not necessarily indicative of the activity of these compounds in other formulations and other parts of the body where other factors come into play. For example, a controlling factor in the onset of cooling effect, its intensity and longevity will be the rate of penetration of the compounds through the epidermis and this will vary in different locations on the human body. The formulation of actual products according to this invention will therefore be done largely on an empirical basis although the test results and other figures given herein will be useful as a guide, particularly in the formulation of products for oral administration, since the test procedure to be described involves oral application of the compound. A similar test may, of course, be devised for the purposes of measuring the relative activities of the compounds on another area of the body, for example, the face or forearm, and this will be a useful guide in the choice of compounds to be used in preparations for external topical usage.

It will also be noted that the described test procedure is done on a statistical basis. This is necessary since sensitivity to these compounds will vary not only from

compound to compound and from one part of the body to another, but also from one individual to another. Tests of this nature are commonly used in the testing of the organoleptic properties, e.g. taste and smell of organic and inorganic compounds, see Kirk-Othmer: Encyclopedia of Chemical Technology, 2nd Ed. (1967) Vol. 14, pages 336-344.

Test Procedure.

The following test procedure is aimed at determining the minimum quantity of the test compound required to produce a noticeable cooling effect in a person of average sensitivity, this minimum quantity being termed the threshold for that particular compound. The tests are carried out on a selected panel of 6 people of medium sensitivity to l-menthol.

Panel Selection.

To select a test panel of average sensitivity the following procedure is used. Known quantities of l-menthol in solution in petroleum ether (bp. 40—60°) are placed on 5 mm. squares of filter paper, whereafter the solvent is allowed to evaporate. A panel of observers is enrolled and asked to place one impregnated square at a time on the tongue and to report on the presence or absence of a cooling effect. The quantity of l-menthol on each impregnated square is gradually reduced from a value substantially above 0.25 μg. per square to substantially below 0.25 μg. the precise range being immaterial. Conveniently, one starts with squares containing 2.0 μg l-menthol, the amount on each successive square being half that of the preceding square, i.e. the second test square will contain 1.0 μg, the third 0.5 μg, and so on. Each quantity is tested on the tongue at least 10 times. In this way, the thresholds to cold receptor stimulus by l-menthol are determined for each individual of the panel, the threshold for each individual being that amount of l-menthol for which, in a series of not less than 10 test applications, a cooling effect is reported 50% of the time. Six panel members are now selected whose threshold is approximately 0.25 μg, this select panel being regarded as the test panel of average sensitivity.

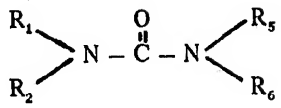
Compound Testing.

To test the activity of compounds according to this invention, the above procedure is repeated using only the 6 selected panel members of average sensitivity to l-menthol. The individual thresholds for each test compound on each of the 6 selected panel members are determined and averaged. Those compounds whose average threshold on the select test panel is 100 μg or less are regarded as having cooling activity in accordance with this invention.

Test Results.

The following tables set out the relative cooling activities of compounds of the formula defined above when tested according to the foregoing procedure.

TABLE I



Compound				Activity	
R_1	R_2	R_5	R_6	bp. or m.p (°C)	μg
sec-C_4H_9-	*sec*-C_4H_9-	H–	C_2H_5-	98–102/ 0.2 mm	1
sec-C_4H_9-	*sec*-C_4H_9-	H–	CH_3-	87–90° (m.p.)	1.5
n-C_4H_9-	*t*-C_4H_9	H–	C_2H_5-	90–92°/ 0.2 mm.	1
iso-C_3H_7-	*iso*-C_3H_7-	C_2H_5	H–	88–92°/ 0.8 mm	5
n-C_5H_{11}-	*iso*-C_3H_7-	H–	*iso*-C_3H_7-	96°/ 0.35 mm	1.5
iso-C_3H_7-	cycloC_6H_{11}-	CH_3–	CH_3–	82–85°/ 0.5 mm.	3
iso-C_4H_9-	*iso*-C_4H_9-	CH_3–	CH_3–	63–65°/ 0.5 mm	3
iso-C_4H_9-	$(CH_3)_2CHCH(CH_3)$–	H–	C_2H_5-	100–106°/ 0.4 mm	1.5
iso-C_4H_9-	*iso*-C_4H_9-	H–	C_2H_5-	99–103°/ 0.2 mm	10
–$CH(CH_3)CH_2CH_2CH_2CH(CH_3)$–		H–	C_2H_5-	91–3° (mp)	10
H–	$(CH_3)_3CCH_2C(CH_3)_2$–	H–	C_2H_5-	100°/ 0.2 mm (sublimed)	8

TABLE I continued

Compound				Activity	
R_1	R_2	R_5	R_6	bp. or mp. (°C)	μg
cycloC_6H_{11}-	*iso*-C_3H_7-	H–	C_2H_5–	104–5° (mp)	8
–$CH(CH_3)CH_2CH_2CH(CH_3)$–		,,	,,	100–3°/ 0.6 mm	10
n-C_4H_9-	*t*-C_4H_9	*iso*-C_3H_7-	H–	81–4°/ 0.5 mm	6
H–	$(CH_3)_3CCH_2C(CH_3)_2$–	C_2H_5-	C_2H_5	98–100°/ 1.0 mm	20
–$CH(CH_3)CH_2CH_2CH_2CH(CH_3)$–		H–	*iso*-C_3H_7-	110–2°/ 0.5 mm	11
cycloC_6H_{11}-	*iso*-C_3H_7-	,,	,,	125–7°/ 0.5 mm	12
H–	$(CH_3)_3CCH_2C(CH_3)_2$–	,,	,,	136–9°/ 0.5 mm	10
iso-C_4H_9	*iso*-C_4H_9-	,,	*n*-C_3H_7-	108–9°/ 0.3 mm	20
–$CH(CH_3)CH_2CH_2CH_2CH(CH_3)$–		,,	*n*-C_4H_9-	129–31°/ 0.4 mm	30
–$CH(CH_3)CH_2CH_2CH(CH_3)$–		,,	,,	112–4°/ 0.1 mm	30
–$CH(CH_3)CH(C_2H_5)CH(CH_3)CH_2$–		,,	*n*-C_3H_7-	*	20
sec-C_4H_9-	*sec*-C_3H_9-	,,	$C_2H_5OCOCH_2$–	*	12
,,	,,	,,	$HOCH_2CH_2CH_2$–	*	10
,,	,,	,,	H–	68–71° (mp)	20

* Compounds not distilled, but were tested in a crude state.

TABLE I continued

Compound				Activity	
R_1	R_2	R_5	R_6	bp. or mp (°C)	μg
$-CH_2(CH_2)_6CH_2-$		H–	*iso*-C_3H_7-	100–110°/ 0.01 mm	7
C_2H_5	$CH(CH_3)_2CH_2CH(CH_3)-$	,,	,,	80–81°/ (mp)	7
H	$CH(iso\text{-}C_3H_7)_2$-	,,	n-C_3H_7-	83–86°/ (mp)	15
$-CH_2CH_2CH(CH_3)CH_2CH_2CH(isoC_3H_7)-$		,,	C_2H_5-	106–10°/ 0.1 mm	4
iso-C_3H_7-	(cyclo C_7H_{13})CH_2-	,,	,,	122–6°/ 0.005 mm	20
$CH(CH_3)_2CH_2CH(CH_3)-$	$CH(CH_3)_2CH_2CH(CH_3)-$	,,	,,	88–90°/ 0.001 mm	20
sec.-C_4H_9-	iso-C_4H_9-	,,	isoC$_3H_7$-	57–60° (mp)	2
C_2H_5-	$CH(CH_3)_2CH(CH_3)-$	,,	,,	46–50° (mp)	8
n-C_3H_7-	$CH(C_2H_5)_2$-	,,	C_2H_5-	81–3°/ 0.005 mm	4
cycloC_5H_9-	iso-C_4H_9-	,,	,,	108–10°/ 0.005 mm	3
sec.C_4H_9-	(cyclo C_6H_{11})CH_2–	,,	,,	106–9°/ 0.005 mm	20
n-C_3H_7-	(1′-methylcycloC_6H_{10})CH_2–	,,	,,	112–4°/ 0.005 mm	15

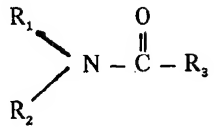
TABLE I continued

Compound				Activity	
R_1	R_2	R_5	R_6	bp. or mp (°C)	μg
cycloC_5H_9-	$CH_3CH_2CH_2CH(CH_3)$–	H–	n-C_3H_7	120–1°/ 0.6 mm	8
(iso-C_3H_7)$_2$CH–	(Cyclo-C_3H_5)CH_2–	,,	C_2H_5-	95–110°/ 0.01 mm	5
C_2H_5-	$(CH_3)_2CHCH(CH_3)$–	,,	$HO(CH_2)_6$–	–	20
,,	,,	n-C_3H_7-	n-C_3H_7-	64–6°/ 0.01 mm	5
,,	,,	$-CH_2CH_2OCH_2CH_2-$		64–5°/ 0.005 mm	1
,,	,,	$-CH_2CH_2CH_2CH_2-$		75–6°/ 0.005 mm	0.5
H	$CH_3CH_2C(CH_3)_2$–	H	iso-C_3H_7-	170–2° (mp)	10
C_2H_5-	$(C_2H_5)_2CH$	,,	,,	64–6° (mp)	3
,,	,,	,,	Cyclo-C_3H_5-	89–91°/ 0.02 mm	0.4
,,	,,	,,	n-C_6H_{13}-	118–9°/ 0.005 mm	3
,,	,,	CH_3–	$HOCH_2CH_2$–	88–92°/ 0.01 mm	6
iso-C_4H_9-	sec.C_4H_9-	H	(cyclo-C_5H_9)CH_2–	124–7°/ 0.3 mm	3
,,	,,	,,	(3′-methyl)CycloC_5H_8-	106–110°/ 0.45 mm	10

TABLE I continued

Compound				Activity	
R_1	R_2	R_5	R_6	bp or mp (°C)	μg
iso-C_4H_7-	iso-C_3H_7-	H	cycloC_6H_{11}-	94–5° (mp)	8
Sec.C_4H_9-	Sec-C_4H_9	,,	,,	80–81° (mp)	10

TABLE II



Compound			Activity	
R_1	R_2	R_3	bp or mp (°C)	μg
sec-C_4H_9-	*sec*-C_4H_9-	C_2H_5-	65–6°/0.2 mm	2
–$CH(CH_3)CH_2CH_2CH_2CH(CH_3)$–		,,	77°/0.5 mm	3
H–	$(CH_3)_3CCH_2C(CH_3)_2$–	,,	88–100°/0.5 mm (sublimed)	5
sec-C_4H_9-	*sec*-C_4H_9-	*n*-C_4H_9-	75–6°/0.18 mm	4
,,	,,	CH_3–	53–6°/0.1 mm	2
iso-C_4H_9-	$(CH_3)_2CHCH(CH_3)$–	,,	68–72°/0.5 mm	2
–$CH(CH_3)CH_2CH_2CH_2CH(CH_3)$–		*t*-C_4H_9-	123–4°/12 mm	2
H–	$(CH_3)_3CCH_2C(CH_3)_2$–	*iso*-C_3H_7-	93–5° (mp)	2
sec-C_4H_9-	*sec*-C_4H_9-	,,	61–2°/0.01 mm	5
n-C_5H_{11}-	*iso*-C_3H_7-	C_2H_5-	68°/0.35 mm	3
cycloC_6H_{11}-	*iso*-C_3H_7-	CH_3–	131–3°/12 mm	8
sec-C_4H_9-	*sec*-C_4H_9-	*iso*-C_3H_7-	111–2°/11 mm	6
–$CH(CH_3)CH_2CH_2CH_2CH(CH_3)$–		,,	134–8°/12 mm	6
iso-C_3H_7-	*iso*-C_3H_7-	C_2H_5	42–6/0.02 mm	8
H–	$(CH_3)_3CCH_2C(CH_3)_2$–	*iso*-C_4H_9-	80–90°/0.5 mm (Sublimed)	7

TABLE II continued

Compound			Activity	
R_1	R_2	R_3	bp. or mp. (°C)	μg
H–	$(CH_3)_3CCH_2C(CH_3)_2$–	*t*-C_4H_9-	83–5°/mp.	5
,,	,,	H–	81–7°/0.3 mm	8
n-C_4H_9-	*t*-C_4H_9-	C_2H_5-	62–4°/0.2 mm	6
–$CH(CH_3)CH_2CH_2CH(CH_3)$		*iso*-C_3H_7–	46–8°/0.01 mm	6
iso-C_4H_9-	*iso*-C_4H_9-	C_2H_5-	65–7°/0.15 mm	12
–$CH(CH_3)CH_2CH_2CH_2CH(CH_3)$–		*n*-C_4H_9-	81–5°/0.35 mm	12
,,		H–	59–63°/0.2 mm	11
H–	$(CH_3)_3CCH_2C(CH_3)_2$–	*n*-C_4H_9-	92°/0.15 mm	20
H–	C_2H_5 $CH(CH_3)CH_2CH(CH_3)$–	C_2H_5-	146–7°/15 mm	18
iso-C_3H_7-	cycloC_6H_{11}-	*n*-C_3H_7-	69–73/.003 mm	11
–$CH(CH_3)$ $CH_2CH_2CH_2CH(CH_3)$–		CH_3–	71–4°/0.5 mm	25
n-C_4H_9-	*t*-C_4H_9-	*iso*-C_4H_9	75–6°/0.2 mm	40
sec-C_4H_9-	*sec*-C_4H_9-	H–	56–8°/0.2 mm	10
–$CH(CH_3)CH_2CH_2CH_2CH(CH_3)$–		*iso*-C_4H_9-	81–6°.0.2 mm	6
sec.-C_4H_9-	iso-C_4H_9-	n-C_3H_7-	60°/0.002 mm	2
,,	,,	H–	70–2°/2.0 mm	4
C_2H_5-	$CH(CH_3)_2CH(CH_3)$–	iso-C_3H_7-	*	2
n-C_3H_7-	$(C_2H_5)_2CH$–	C_2H_5-	60–2/0.02 mm	5

* Not distilled, tested crude.

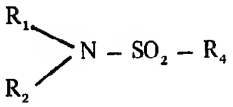
TABLE II continued

Compound			Activity	
R_1	R_2	R_3	bp. or mp. (°C)	μg
cycloC_5H_9-	iso-C_4H_9-	C_2H_5-	89°/0.5 mm	6
sec-C_4H_9-	(cyclo-C_6H_{11})CH_2–	CH_3–	72–4°/0.003 mm	15
CH_3–	$(CH_3)_3CCH_2C(CH_3)_2$–	C_2H_5-	55–7°/0.01 mm	3
sec.C_4H_9-	cycloC_7H_{13}-	,,	83–5°/0.02 mm	9
$(isoC_3H_7)_2CH$–	(cycloC_3H_5)CH_2–	cyclo-C_4H_7-	88–92°/0.005 mm	6
iso-C_3H_7-	iso-C_4H_9-	n-C_6H_{13}-	90–2°/0.2 mm	4
H–	$(CH_3)_2CH(CH_2)_3CH(CH_3)$–	,,	136–41°/0.2 mm	20
C_2H_5-	$(CH_3)_2CHCH(CH_3)$–	$HO(CH_2)_5$–	120–6°/0.01 mm	8
iso-C_3H_7-	iso-C_3H_7-	$C_2H_5OOC(CH_2)_4$–	104–9°/0.01 mm	4
,,	,,	$HOOC(CH_2)_4$–	150–70°/0.7 mm	30
C_2H_5	$CH(CH_3)_2CH_2CH(CH_3)$–	C_2H_5–	52–3°/0.01 mm	2
sec.C_4H_9-	sec.-C_4H_9-	cyclo C_6H_{11}-	86–7°/0.005 mm	9
–$CH(CH_3)CH_2CH_2CH_2CH(CH_3)$–		,,	120–6°/0.01 mm	15
H	$(isoC_3H_7)_2CH$–	iso C_3H_7-	130–1°/m.p.	3
H	$(CH_3)_3CCH_2C(CH_3)_2$–	cyclo C_6H_{11}-	114–6°/m.p.	40
–$CH_2CH_2CH(CH_3)CH_2CH_2CH$(iso C_3H_7)–		CH_3–	73–4°/0.15 mm	3
C_2H_5-	$CH(CH_3)_2CH(CH_3)$–	$C_2H_5OOC(CH_2)_4$–	107–8°/0.001 mm	20
iso-C_3H_7-	(cyclo C_7H_{13})CH_2–	C_2H_5-	106–8°/0.5 mm	20
sec. C_4H_9-	sec. C_4H_9-	$(CH_3)_3CCH_2$–	74–75°/0.3 mm	5

TABLE II continued

Compound			Activity	
R_1	R_2	R_3	bp. or mp. (°C)	μg
C_2H_5-	$CH(CH_3)_2CH(CH_3)$–	$(CH_3)_3CCH_2$–	68–9°/0.4 mm	6
iso-C_4H_9-	,,	cyclo C_3H_5-	70°/0.2 mm	4
n-C_3H_7-	$(C_2H_5)_2CH$–	cyclo C_4H_7-	78.5–80°/0.1 mm	4
C_2H_5-	iso C_4H_9-	,,	63–4°/0.2 mm	3
–$CH(CH_3)CH_2CH_2CH_2CH(CH_3)$–		cyclo C_3H_5-	77–82°/0.2 mm	2
,,		cyclo C_4H_7-	80°/0.25 mm	2
,,		cyclo C_5H_9-	103–7°/0.6 mm	5
iso C_3H_7	iso C_4H_9-	cyclo C_3H_5-	55°/0.005 mm	2
,,	,,	cyclo C_5H_9-	101–3°/2 mm	3
	–$CH_2(CH_2)_6CH_2$–	C_2H_5-	59°/0.005 mm	7
sec. C_4H_9-	(cyclo C_3H_5)CH_2–	,,	58–9°/0.01 mm	3
$(CH_3)_2CHCH_2CH(CH_3)$–	$(CH_3)_2CHCH_2CH(CH_3)$–	CH_3–	58–9°/0.01 mm	10
H	(iso $C_3H_7)_2CH$–	cyclo C_3H_5-	136–8°/mp.	4

TABLE III



Compound			Activity	
R_1	R_2	R_4	b.p. °C	μg
sec-C_4H_9-	*sec*-C_4H_9-	CH_3–	90–3°/0.7 mm	1
iso-C_3H_7-	*iso*-C_3H_7-	C_2H_5-	84–6°/0.3 mm	8
$CH(CH_3)CH_2CH_2CH_2CH(CH_3)$–		,,	98–100°/0.3 mm	7
C_2H_5-	$(CH_3)_2CHCH(CH_3)$–	,,	93–4°/0.4 mm	8
–$CH(CH_3)CH(C_2H_5)CH(CH_3)CH_2$–		,,	106–7°/0.4 mm	6
iso-C_3H_7-	cycloC_6H_{11}-	,,	109–115°/0.3 mm	10
H–	$(CH_3)_3CCH_2C(CH_3)_2$–	,,	115–8°/0.3 mm	20
–$CH_2CH(C_2H_5)CH_2CH_2CH(CH_3)$–		CH_3–	107–9°/0.3 mm	15
iso-C_3H_7-	*iso*-C_4H_9-	n-C_3H_7-	74–6°/0.005 mm	9
C_2H_5-	*iso*-C_4H_9-	n-C_5H_{11}-	95–8°/0.15 mm	9

Utility

The cold receptor stimulants used in this invention find utility in a wide variety of consumer products for consumption by or application to the human body. Broadly speaking, these products can be divided into ingestibles and topicals, both terms being taken in their broadest possible sense. Thus ingestible is to be taken as including not only foodstuffs and beverages taken into the mouth and swallowed, but also other orally ingested products taken for reasons other than their nutritional value, e.g. indigestion tablets, antacid preparations and laxatives. Ingestible is also to be taken to include edible compositions taken by mouth, but not necessarily swallowed, e.g. chewing gum. Topical is to be taken as including not only compositions such as perfumes, powders and other toiletries, lotions, liniments, oils and ointments, applied to the external surfaces of the human body, whether for medical or other reasons, but also compositions applied to, or which, in normal usage, come in contact with, internal mucous membranes of the body, such as those of the nose, mouth, or throat, whether by direct or indirect application, mouthwash and gargle compositions. Topical products, in this context, also include toilet articles such as cleansing tissues and toothpicks.

In formulating the products of this invention the cold receptor stimulants will be incorporated into a vehicle by means of which the compound may be applied to the person. The vehicle may, itself be completely inert or it may, and usually will, contain other active ingredients. A wide variety of vehicles will be suitable, depending upon the particular product involved, such vehicles including solids, liquids, emulsions, foams and gels. Typical vehicles for the cold receptor stimulants include aqueous or alcoholic solutions, oils and fats such as hydrocarbon oils, fatty acid esters, long chain alcohols and silicone oils; finely divided solids such as starch or talc; cellulosic materials such as paper tissue; low-boiling hydrocarbons and halohydrocarbons used as aerosol propellants; gums and natural or synthetic resins.

Generally, these vehicles will contain at least one or more of the following adjuvants: flavourants, colourants, perfuming agents, surface active agents, antiseptic agents, such as are usually employed in topical and ingestible compositions.

A more detailed discussion of particular products according to this invention follows.

Toiletries and Cosmetics.

A major area of utility of the cold receptor stimulants of this invention will be in the field of toilet preparations broadly classed as personal care products. These may be defined as manufactured products applied to the person for the purposes of grooming or hygiene or for cosmetic purposes, including make up and perfumery, but excluding ethical and proprietary medical preparations. Particular personal care products are discussed hereinafter by way of example and are illustrated hereinafter in the specific examples.

One class of personal care product into which the compounds of this invention may be incorporated is represented by lotions for topical application, e.g. after-shave lotions and toilet water where the compound will be used in alcoholic or aqueous alcoholic solution, such solutions usually also containing a perfume or mild antiseptic or both. The amount of compound added to the formulation will usually be in the range 0.1 to 2.5% by weight based on the total composition.

Another class of personal care product is represented by soap and soap-based compositions where the compounds will be used in combination with an oil or fat or a natural or synthetic surfactant e.g. a fatty acid salt or a laurylsulphate salt, the composition usually also containing an essential oil or perfume. The range of soap compositions will include soaps of all kinds e.g. toilet soaps, shaving soaps and shaving foams particularly shaving foams of the aerosol type. Usually the compound will be added to the formulation in amount of from 0.5 to 2.5% by weight.

A further class of personal care products into which the cold receptor stimulants may be incorporated is represented by cosmetic creams, emollients and lotions, such creams, emollients and lotions usually comprising an oil-in-water emulsion as a base and optionally containing a range of other ingredients such as wax, preservative, perfume, antiseptics, astringents and pigments. Also included within this class are lipstick compositions, such compositions usually comprising an oil and wax base into which the coolant can be incorporated along with other ingredients e.g. pigments. Once again the formulation of such products, apart from the incorporation of the cold receptor stimulant, usually in an amount by weight of from 0.1 to 2.5%.

Personal care products for oral hygiene into which the cold receptor stimulants of this invention can be incorporated include mouthwash, gargle and dentifrice compositions. The first two may be considered together and will usually comprise an

aqueous, alcoholic or aqueous-alcoholic solution of an antiseptic often coloured or flavoured for palatability, to which the cold receptor stimulant is usually added in an amount of from 0.01 to 1.0% by weight.

Dentifrice compositions may be of the solid block, powder, paste or liquid type and will usually comprise a finely divided abrasive or polishing material, e.g. precipitated chalk, silica, magnesium silicate, aluminium hydroxide or other similar materials well known in the art, and a detergent or foaming agent. Optional ingredients which may also be included are flavouring agents and colourants, antiseptics, lubricants, thickeners, emulsifiers or plasticizers. The amount of cold receptor stimulant added in such compositions will generally be from 0.1 to 2.0% by weight based on the total composition.

Edible and Potable Compositions.

The cold receptor stimulants of this invention may be incorporated into a wide range of edible and potable compositions comprising an edible or potable base and usually one or more flavouring or colouring agents. The particular effect of the cold receptor stimulant is to create a cool or fresh sensation in the mouth, and in some cases, even in the stomach, and therefore the compounds find particular utility in sugar-based confectionery such as chocolate, boiled sweets, mints and candy, in ice cream and jellies and in chewing gum. The formulation of such confections will be by traditional techniques and according to conventional recipes and as such forms no part of this invention. The cold receptor stimulant will be added to the recipe at a convenient point and in amount sufficient to produce the desired cooling effect in the final product. As already indicated, the amount will vary depending upon the particular compound, the degree of cooling effect desired and the strength of other flavourants in the recipe. For general guidance, however, amounts in the range 0.01 to 1.0% by weight based on the total composition will be found suitable.

Similar considerations apply to the formulation of beverages. Generally speaking the compounds will find most utility in soft drinks, e.g. fruit squashes, lemonade and cola, but may also be used in alcoholic beverages. The amount of compound used will generally be in the range 0.01 to 1.0% by weight based on the total composition.

Medicaments.

Because of their cooling effect on the skin and on the musous membranes of the mouth, throat and nose and of the gastrointestinal tract the cold receptor stimulants may be used in a variety of oral medicines, nasal and throat sprays, and topical compositions, particularly where a counter-irritant is required. Generally speaking, these medical preparations, whether topical or ingestible, proprietary or ethical, will contain a pharmaceutically acceptable carrier, either liquid or solid, a pharmaceutically active ingredient and into these preparations the cold receptor stimulants of this invention can readily be incorporated to provide a pleasant cooling effect on the skin, or other surface tissues of the body, or in the mouth or gastrointestinal tract depending on particular preparation and whether it is to be applied externally or internally. A particular utility for the compounds of this invention is in the formulation of antacid and indigestion remedies, and especially those based on sodium bicarbonate, magnesium oxide, calcium or magnesium carbonate, aluminium or magnesium hydroxide or magnesium trisilicate. In such compositions the compound will usually be added in an amount of from 0.1 to 2.0%.

The cold receptor stimulants may also be included in oral analgesic compositions, e.g. with acetyl salicyclic acid or its salts, and in nasal decongestants e.g. those containing ephedrine.

Consumer products according to the invention are illustrated by the following Examples in which all percentages are by weight.

EXAMPLE 1.

After-Shave Lotion.

An after-shave lotion was prepared according to the following recipe by dissolution of the ingredients in the liquid and cooling and filtering:

Denatured ethanol	75%
Diethylphthalate	1.0%
Propylene Glycol	1.0%
Lactic Acid	1.0%
Perfume	3.0%
Water	to 100%

Into the base lotion was added 0.5% by weight of N-ethyl-N',N'-di-*sec*-butyl urea.

When the final solution was applied to the face a clearly noticeable cooling effect became apparent after a short interval of time.

EXAMPLE 2.

Antiseptic Ointment.

An ointment was prepared according to the following formulation:

Cetyltrimethyl ammonium bromide	4.0%
Cetyl Alcohol	6.0%
Stearyl Alcohol	6.0%
White Paraffin	14.0%
Mineral Oil	21.0%
Water	to 100%

The ingredients were mixed, warmed to 40° C. and emulsified in a high speed blender. Added to the mixture during blending was 1.5% of N,N-dimethyl-N'-cyclohexyl-N'-isopropyl urea.

The final ointment when applied to the skin gave rise to a cooling effect.

EXAMPLE 3.

Cleansing Tissue.

A cleansing liquid was prepared having the formulation:

Triethanolamine Lauryl sulphate	1.0%
Glycerol	2.0%
Perfume	.95%
Water	to 100%

To this liquid was added 1.0% of N-ethyl-N'-*n*-butyl-N'-*t*-butyl urea. A paper tissue was then soaked in the liquid.

When the impregnated tissue was used to wipe the skin a fresh cool sensation developed on the skin after a short interval.

EXAMPLE 4.

Toothpaste.

The following ingredients were mixed in a blender:

Dicalcium phosphate	48.0%
Sodium lauryl sulphate	2.5%
Glycerol	24.8%
Sodium carboxymethyl cellulose	2.0%
Citrus flavourant	1.0%
Sodium saccharin	0.5%
Water	to 100%

Shortly before completion of the blending operation 1.0% by weight of N-(2,2-dimethylpropionyl)-2,6-dimethylpiperidine was added to the blender.

When applied as a toothpaste a pleasant cooling effect is noticed in the mouth.

EXAMPLE 5.

Aerosol Shaving Soap.

An aerosol shaving soap composition was formulated according to the following recipe:

Stearic Acid	6.3%
Lauric Acid	2.7%
Triethanolamine	4.6%
Sodium Carboxymethyl Cellulose	0.1%
Sorbitol	5.0%
Water	to 100%
Perfume	0.5%

The composition was prepared by fusing the acids in water, adding the triethanol-

amine, cooling and adding the other constituents. To the mixture was then added 0.5% of N,N-di-*sec*-butyl propionamide.

The composition was then packaged in an aerosol dispenser under pressure of a butane propellant.

When used in shaving a fresh cool sensation was noticed on the face.

EXAMPLE 6.

Soft Drink.

A soft drink concentrate was prepared from the following recipe:

Pure orange juice	60%
Sucrose	10%
Saccharin	0.2%
Orange flavouring	0.1%
Citric acid	0.2%
Sulphur dioxide	trace amount
Water	to 100%

To the concentrate was added 0.10% of N-(2,4,4-trimethylpent-2-yl)-2-methyl-propionamide.

The concentrate was diluted with water and tasted. An orange flavour having a pleasantly cool after-effect was obtained.

EXAMPLE 7.

Toothpick.

The tip of a wooden toothpick was impregnated with an alcoholic solution containing N,N-di-*sec*-butyl methane-sulphonamide in an amount sufficient to deposit on the toothpick 0.05 mg. of the compound. The toothpick was then dried.

When placed against the tongue a cool sensation is noticed after a short period of time.

EXAMPLE 8.

After Shave Lotion.

An after shave lotion was prepared according to the following recipe by dissolution of the ingredients in the liquid and cooling and filtering:

Denatured ethanol	75%
Diethylphthalate	1.0%
Propylene Glycol	1.0%
Lactic Acid	1.0%
Perfume	3.0%
Water	to 100%

Into a sample of the base lotion was added 0.7% by weight based on the weight of the sample of N-propionyl-2,6-dimethylpiperidine.

When the final solution was applied to the face a clearly noticeable cooling effect became apparent after a short interval of time.

EXAMPLE 9.

Cleansing Tissue.

A cleansing tissue liquid was prepared having the formulation:

Triethanolamine lauryl sulphate	1.0%
Glycerol	2.0%
Perfume	.95%
Water	to 100%

To this liquid was added 1% of N-isobutyl-N-sec . butyl butanamide. A paper tissue was then soaked in the liquid.

When the impregnated tissue was used to wipe the skin a fresh cool sensation developed on the skin after a short interval.

EXAMPLE 10.

Toothpaste.

The following ingredients were mixed in a blender:

Dicalcium phosphate	48.0%
Sodium lauryl sulphate	2.5%
Glycerol	24.8%
Sodium carboxymethyl cellulose	2.0%
Citrus flavourant	1.0%
Sodium saccharin	0.5%
Water	to 100%

Shortly before completion of the blending operation 1% by weight of N-n-pentyl-(N,N')diisopropylurea was added to the blender.

When applied as a toothpaste a pleasant cooling effect is noticed in the mouth.

EXAMPLE 11.

Aerosol Shaving Soap.

An aerosol shaving soap composition was formulated according to the following recipe:

Stearic acid	6.3%
Lauric acid	2.7%
Triethanolamine	4.6%
Sodium carboxymethyl cellulose	0.1%
Sorbitol	5.0%
Water	to 100%
Perfume	0.5%

The composition was prepared by fusing the acids in water, adding the triethanolamine, cooling and adding the other constituents. To the mixture was then added 0.7% of N-isobutyl-N'-ethyl-N-(1,2-dimethyl-n-propyl)urea. The composition was then packaged in an aerosol dispenser under pressure of a butane propellant.

EXAMPLE 12.

Toothpaste.

The following ingredients were mixed in a blender:

Dicalcium prosphate	48.0%
Sodium lauryl sulphate	2.5%
Glycerol	24.8%
Sodium carboxymethyl cellulose	2.0%
Citrus flavourant	1.0%
Sodium saccharin	0.5%
Water	to 100%

Shortly before completion of the blending operation 1.5% by weight of N,N-diisopropyl ethanesulphonamide was added to the blender.

When applied as a toothpaste a pleasant cooling effect is noticed in the mouth.

EXAMPLE 13.

Aerosol Shaving Soap.

An aerosol shaving soap composition was formulated according to the following recipe:

Stearic acid	6.3%
Lauric acid	2.7%
Triethanolamine	4.6%
Sodium carboxymethyl cellulose	0.1%
Sorbitol	5.0%
Water	to 100%
Perfume	0.5%

The composition was prepared by fusing the acids in water, adding the triethanolamine, cooling and adding the other constituents. To the mixture was then added 1.0% of N-isobutyl-N-isopropyl propanesulphonamide. The composition was then packaged in an aerosol dispenser under pressure of a butane propellant.

When used in shaving a fresh cool sensation is distinctly noticeable on the face.

EXAMPLE 14.

Hair Shampoo.

Sodium lauryl ether sulphate, 10 g., was dispersed in 90 g. water in a high speed mill. To the dispersion was added 2% by weight of N-*n*-butyl-N,N'-di-sec . butylurea. When the hair is washed using the shampoo a fresh, cool sensation is noticed on the scalp.

EXAMPLE 15.

Toothpick.

The tip of a wooden toothpick was impregnated with an alcoholic solution containing N'-[N-ethyl-N-(1,2-dimethyl-n-propyl)carbamoyl]pyrrolidine, in an amount sufficient to deposit on the toothpick 0.05 mg. of the compound. The toothpick was then dried.

When placed against the tongue a cool sensation is noticed after a short period of time.

EXAMPLE 16.

Soft Drink.

A soft drink concentrate was prepared from the following recipe:

Pure orange juice	60%
Sucrose	10%
Saccharin	0.2%
Orange flavouring	0.1%
Citric acid	0.2%
Sulphur dioxide	Trace amount
Water	to 100%

To the concentrate was added 0.2% of N,N-di-sec . butyl ethanesulphonamide. The concentrate was diluted with water and tasted. An orange flavour having a pleasantly cool after-effect was obtained.

EXAMPLE 17.

Toilet Water.

A toilet water was prepared according to the following recipe:

Denatured ethanol	75.0%
Perfume	5.0%
Water	to 100%

To the recipe was added 2.0% based on the total composition, of N,N-di-sec . butyl methanesulphonamide.

As with the after-shave lotions, a cooling effect was clearly noticeable on the skin well after the termination of any cooling effect attributable to the evaporation of the alcoholic carrier.

EXAMPLE 18.

Soft Sweet.

Water was added to icing sugar at 40° C. to form a stiff paste. 0.2% of N-n-propyl-N-(1-ethyl-n-propyl)-N'-cyclopropylurea was then stirred into the paste and the mixture allowed to set. A soft sweet mass resulted having the characteristic cooling effect in the mouth of peppermint but without the minty flavour or odour.

EXAMPLE 19.

Hydrophilic Ointment.

A hydrophilic ointment was prepared having the following formulation:

Propylene Glycol	12%
1-Octadecanol	25%
White soft paraffin	25%
Sodium lauryl sulphate	1%
Water	to 100%

The sodium lauryl sulphate was added to the water and heated to 60° C. The paraffin was melted by heating to 60° C. and was then added to the sodium lauryl

sulphate mixture with stirring. Propylene glycol and 1-octadecanol was then added to this mixture.

To the resultant mixture was added 1.5% of N-isobutyl-N-sec . butyl formamide. The final ointment when applied to the skin gave rise to a marked cooling effect.

EXAMPLE 20.

Deodorant Composition.

A deodorant composition suitable for formulation and dispensing as an aerosol under pressure of a suitable propellant was formulated according to the following recipe:

Denatured ethanol	96.9%
Hexachlorophene	2.0%
Isopropyl myristate	1.0%
Perfume	0.1%

To the composition was added 2% by weight of N-isobutyl-N'-ethyl-N-cyclopentyl urea. Application of the final composition gave rise to a definite cooling sensation on the skin.

EXAMPLE 21.

Lipstick.

1.0% by weight of N-ethyl-N-(1,2-dimethyl-n-propyl)-6-hydroxyhexanamide was incorporated into a proprietary lipstick by melting the lipstick, adding the compound, and allowing the lipstick to resolidify. When applied to the lips a persistent cooling effect is clearly noticeable.

EXAMPLE 22.

Solid Cologne.

A solid cologne was formulated according to the following recipe:

Denatured ethanol	74.5%
Propylene glycol	3.0%
Sodium stearate	5.0%
Perfume	5.0%
Water	to 100%

The sodium stearate was dissolved by stirring in a warm mixture of the ethanol, propylene glycol and water. To the solution was added the perfume and 2% of N-isopropyl-N-isobutyl cyclopentanecarboxamide, and the mixture then allowed to solidify into a waxy cake.

When applied to the forehead a strong cooling effect is obtained.

EXAMPLE 23.

Hair Tonic.

A hair tonic was formulated containing:

Denatured ethanol	84.5%
Castor oil	14.0%
Resorcinol	0.5%
Perfume	1.0%

The castor oil, resorcinol and perfumes were dissolved in the ethanol component and to the solution was added 2% of N-ethanesulphonyl-2,6-dimethylpiperidine. When rubbed on the scalp a cooling effect is noticed.

EXAMPLE 24.

Mouthwash.

A concentrated mouthwash composition was prepared according to the following recipe:

Ethanol	3.0%
Borax	2.0%
Sodium bicarbonate	1.0%
Glycerol	10.0%
Flavourant	0.4%
Thymol	0.03%
Water	to 100%

To the composition was added 0.1% of N-methyl-N-2-hydroxyethyl-N'-n-propyl-N'-(1'-ethyl-n-propyl) urea.

When diluted with approximately 10 times its own volume of water and used to rinse the mouth a strong cooling effect is obtained in the mouth.

EXAMPLE 25.

Talcum Powder.

A talcum powder was prepared by grinding together the following:

Low micron talc	90%
Zinc stearate	5%
Starch	5%

In the course of grinding there was added 1.0% of N-sec . butyl-N-isobutyl-N'-isopropylurea. A talcum powder having a freshening and cooling effect was obtained.

EXAMPLE 26.

Chewing Gum.

Leaves of a proprietary chewing gum were leached in running water for 168 hours to remove all water-soluble flavourants. At the end of the leaching operation the chewing gum base had no detectable minty odour or flavour. The chewing gum base was then kneaded with 0.5% of N-[N'-ethyl-N'-(1,2-dimethyl-n-propyl)carbamoyl]-morpholine. When compared with the water-extracted chewing gum base, the final product showed no distinguishable change in flavour but showed a marked cooling effect in the mouth.

EXAMPLE 27.

Toilet Water.

A toilet water was prepared according to the following recipe:

Denatured ethanol	75.0%
Perfume	5.0%
Water	to 100%

To the recipe was added 1.0% based on the total composition, of N-[N'-ethyl-N'-(1,2-dimethyl-n-propyl)-carbamoyl]pyrrolidine. As with the after-shave lotion, a cooling effect was clearly noticeable on the skin well after the termination of any cooling effect attributable to the evaporation of the alcoholic carrier.

EXAMPLE 28.

Soft Sweet.

Water was added to icing sugar at 40° C. to form a stiff paste. 0.2% of N-cyclohexyl-N-isopropylacetamide was then stirred into the paste and the mixture allowed to set. A soft sweet mass resulted having the characteristic cooling effect in the mouth of peppermint but without the minty flavour or adour.

EXAMPLE 29.

Hydrophilic Ointment.

A hydrophilic ointment was prepared having the following formulation:

Propylene Glycol	12%
1-Octadecanol	25%
White Soft Paraffin	25%
Sodium lauryl sulphate	1%
Water	to 100%

The sodium lauryl sulphate was added to the water and heated to 60° C. The paraffin was melted by heating to 60° C. and was then added to the sodium lauryl sulphate mixture with stirring. Propylene glycol and 1-octadecanol was then added to this mixture.

To the resultant mixture was added 1.5% of N,N-di-sec . butyl ethanesulphonamide.

The final ointment when applied to the skin gave rise to a marked cooling effect.

EXAMPLE 30.

Deodorant Composition.

A deodorant composition suitable for formulation and dispensing as an aerosol under pressure of a suitable propellant was formulated according to the following recipe:

Denatured ethanol	96.9%
Hexachlorophene	2.0%
Isopropyl myristate	1.0%
Perfume	0.1%

To the composition was added 1% by weight of N,N-di-sec . butyl methanesulphonamide. Application of the final composition gave rise to a definite cooling sensation on the skin.

EXAMPLE 31.

Lipstick.

1.0% by weight of N-isobutyl-N-sec . butyl-N'-cyclopentylurea was incorporated into a proprietary lipstick by melting the lipstick, adding the compound, and allowing the lipstick to resolidify. When applied to the lips a persistent cooling effect is clearly noticeable.

EXAMPLE 32.

Solid Cologne.

A solid cologne was formulated according to the following recipe:

Denatured ethanol	74.5%
Propylene glycol	3.0%
Sodium stearate	5.0%
Perfume	5.0%
Water	to 100%

The sodium stearate was dissolved by stirring in a warm mixture of the ethanol, propylene glycol and water. To the solution was added the perfume and 1.0% of N,N-diisobutyl-N',N'-dimethylurea, and the mixture then allowed to solidify into a waxy cake.

When applied to the forehead a strong cooling effect is obtained.

EXAMPLE 33.

Hair Tonic.

A hair tonic was formulated containing:

Denatured ethanol	84.5%
Castor Oil	14.0%
Resorcinol	0.5%
Perfume	1.0%

The castor oil, resorcinol and perfumes were dissolved in the ethanol component and to the solution was added 1.0% of N-(2,2-dimethylpropionyl)-2,6-dimethylpiperidine. When rubbed on the scalp a cooling effect is noticed.

EXAMPLE 34.

Mouthwash

A concentrated mouthwash composition was prepared according to the following recipe:

Ethanol	3.0%
Borax	2.0%
Sodium bicarbonate	1.0%
Glycerol	10.0%
Flavourant	0.4%
Thymol	0.03%
Water	to 100%

To the composition was added 0.1% of N-(2,4,4-trimethylpent-2-yl)-2-methylpropionamide. When diluted with approximately 10 times its own volume of water and used to rinse the mouth a strong cooling effect is obtained in the mouth.

EXAMPLE 35.

Talcum Powder.

A talcum powder was prepared by grinding together the following:

Low micron talc	90%
Zinc stearate	5%
Starch	5%

In the course of grinding there was added 2% of N-(2,4-dimethylpent-3-yl)-2-methylpropionamide. A talcum powder having a freshening and cooling effect was obtained.

EXAMPLE 36.

Chewing Gum.

Leaves of a proprietary chewing gum were leached in running water for 168 hours to remove all water-soluble flavourants. At the end of the leaching operation the chewing gum base had no detectable minty odour or flavour. The chewing gum base was then kneaded with 0.05% of N-n-propyl-N-(1-ethyl-n-propyl)cyclobutanecarboxamide. When compared with the water-extracted chewing gum base, the final product showed no distinguishable change in flavour but showed a marked cooling effect in the mouth.

The above Examples illustrate the range of compounds and the range of compositions included within the present invention. However, they are not to be taken as limiting the scope of the invention in any way. Numerous other compounds within the general formula will be equally suitable for use in the compositions of Examples 1—36 and the physiological cooling effect obtained with the compounds of the invention will recommend their use in a wide variety of other compositions where the cooling effect will be of value.

The substituted ureas, amides and sulphonamides hereinbefore referred to as cold receptor stimulants in ingestible and topical compositions also find utility as cold receptor stimulants in tobacco and tobacco-containing manufactures.

As has already been mentioned, menthol is extensively used for this purpose notwithstanding its strong minty odour and relative volatility. Other similar compounds have also been proposed as alternatives to menthol in tobacco, see for example, the various publications hereinbefore referred to. Still other compounds have been proposed as 'flavourants' in tobacco rather than 'coolants' and amongst these may be mentioned 2-isopropyl-5-methyl hexanol (alternatively named 2,6-dimethylhept-3-yl methanol) and related compounds as disclosed in U.S. Patent No. 3,704,714. Notwithstanding these various disclosures a need still exists for alternatives to menthol for incorporating into tobacco to provide a 'cool' effect when smoked.

It is a further object of the present invention, therefore, to provide tobacco and tobacco-containing manufactures containing an ingredient which creates a 'cool' sensation when the ingredient comes into contact with the nasal and oral mucosa, either in the tobacco smoke, or by direct contact of the tobacco on the nasal or oral mucosa, but which are not subject to the disadvantages of a strong minty flavour and storage instability.

It is a yet further object of the present invention to provide an improved method of imparting to tobacco and tobacco-containing manufactures a physiological cooling activity.

According to the present invention, therefore, there are also provided tobacco and tobacco-containing manufactures comprising tobacco and a sold receptor stimulating additive, present in an amount effective to stimulate the cold receptors of the nervous system of musous membranes of the oral and nasal mucosa when the tobacco or tobacco-containing manufacture is smoked, chewed or inhaled by the human user, said additive being a cold receptor stimulating compound of formula (I) hereinbefore defined.

By tobacco and tobacco-containing manufactures we mean any article, such as cigarette or cigar, or any composition, such as pipe or chewing tobacco or snuff, containing tobacco in a prepared form ready for utilisation by the human person whether by smoking, i.e. burning of the prepared tobacco and inhalation of the tobacco smoke, chewing or direct inhalation of the tobacco.

In formulating the tobacco and tobacco-containing manufactures of this invention

the active compound may be incorporated directly into the tobacco, for example, by impregnation of the tobacco with an alcoholic solution of the active ingredient, at a suitable stage of manufacture. However, in an alternative and preferred arrangement the active ingredient may be incorporated into a tobacco smoke filter for use in a pipe or cigarette filter or as a filter tip for cigarettes. The latter, in particular, forms a particularly effective utilisation of the present invention, the active compound simply being impregnated in the wad of material forming the filter tip. This may be of any of the well known types of filter tip for cigarettes, e.g. a filter pad of cellulose acetate, paper, cotton, α-cellulose or asbestos fiber. Conveniently the filter tip is impregnated with an alcoholic solution of the active compound and then dried to deposit the active compound therein.

The amount of active compound to be incorporated into the tobacco or tobacco-containing manufacture in accordance with the invention will vary from compound to compound depending on the activity thereof, i.e. the amount thereof which it is necessary to place in contact with the skin to produce a noticeable cooling effect, and will depend also on the mode of application thereof, i.e. whether the compound is impregnated in the tobacco itself, or in a filter tip or in any other accessory. However, the actual amount is not critical to this invention and will be readily determinable by the person skilled in the art by means of a few simple tests. As a matter of guidance, however, it may be mentioned that with the more active compounds, as little as 0.1 mg. deposited on the filter tip of a tipped cigarette is effective.

This latter aspect of the invention is illustrated by the following Examples.

EXAMPLE 37.

Cigarette Tobacco.

A proprietary brand of cigarette tobacco was sprayed with an ethanolic solution of N,N-di-*iso*butyl-N',N'-dimethyl urea and was rolled into cigarettes each containing approximately 0.5 mg. of active compound. Smoking the impregnated cigarettes produced a cool effect in the mouth characteristic of mentholated cigarettes but without any attendant odour other than that normally associated with tobacco.

Impregnation of the filter tip of a proprietary brand of tipped cigarette with 0.5 mg. of N,N-di-*sec*-butyl acetamide produced a similar effect.

EXAMPLE 38.

Cigarette Tobacco.

A proprietary brand of cigarette tobacco was sprayed with an ethanolic solution of N-(2,4,4-trimethylpent-2-yl) propionamide and was rolled into cigarettes each containing approximately 0.5 mg. of active compound. Smoking the impregnated cigarettes produced a cool effect in the mouth characteristic of mentholated cigarettes.

EXAMPLE 39.

Filter Tip Cigarettes.

The filter tip of a proprietary brand of cigarette was impregnated with an ethanol solution of N,N-disec . butyl methanesulphonamide in an amount sufficient to deposit in the filter 0.5 mg. of the active compound. Smoking the cigarette with the impregnated tip gave rise to a noticeable cooling effect in the mouth.

EXAMPLE 40.

Pipe Tobacco.

A proprietary brand of pipe tobacco was sprayed with an ethanolic solution of N-*n*-butyl-N-*t*-butyl-N'-ethylurea. 2g. of the tobacco containing 0.5 mg. of the active compound was placed in a pipe. Smoking the impregnated tobacco produced a cool effect in the mouth characteristic of mentholated tobacco but without any attendant odour other than that normally associated with tobacco.

EXAMPLE 41.

Cigars.

The tobacco of a proprietary brand of cigar was impregnated with an ethanolic solution of N-(1,3-dimethylbutyl)-N-ethylpropionamide in an amount sufficient to deposit in the cigar 0.5 mg. of the active compound. Smoking the cigar with the impregnated tobacco gave rise to a noticeable cooling effect in the mouth.

EXAMPLE 42.

Chewing Tobacco.

A proprietary brand of chewing tobacco was impregnated with an ethanolic solution of N-acetyl-2,6-dimethylpiperidine. 1g. of the tobacco containing 0.2 mg. of active compound was used. Chewing the impregnated tobacco produced a cool effect in the mouth.

EXAMPLE 43.

Snuff.

A proprietary brand of snuff was impregnated with an ethanolic solution of N-isobutyl-n-sec . butyl-N'-isopropylurea. 1g. of the snuff was impregnated with 5 mg. of active compound. About 0.01 g. of the impregnated snuff produced a cool effect in the nose when inhaled.

EXAMPLE 44.

Cigarette Tobacco.

A proprietary brand of cigarette tobacco was sprayed with an ethanolic solution of N,N-disec . butyl ethanesulphonamide and was rolled into cigarettes each containing approximately 0.5 mg. of active compound. Smoking the impregnated cigarettes produced a cool effect in the mouth characteristic of mentholated cigarettes but without any attendant odour other than that normally associated with tobacco.

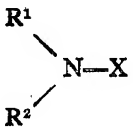
EXAMPLE 45.

Filter Tip Cigarette.

The filter tip of a proprietary brand of cigarette was impregnated with an ethanolic solution of N-[N'-ethyl-N'-(1,2-dimethyl-*n*-propyl)carbamoyl]pyrrolidine in an amount sufficient to deposit in the filter 0.5 mg. of the active compound. Smoking the cigarette with the impregnated tip gave rise to a noticeable cooling effect in the mouth.

WHAT WE CLAIM IS:—

1. A consumer product for application to or consumption by the human body in which there is incorporated, in an amount effective to stimulate the cold receptors of the nervous system of the surface tissues of those parts of the human body with which the product comes in contact during use, a cold receptor stimulating compound of the formula:

I 

where R_1, when taken separately, is H, C_1—C_7 alkyl or C_3—C_6 cycloalkyl;

R_2, when taken separately, is C_3—C_8 alkyl or C_3—C_8 alkylcycloalkyl, alkylcycloalkylalkyl, cycloalkyl, or cycloalkylalkyl, with the proviso that R_2 is branched at an alpha carbon atom relative to the N atom when R_1 is H or at an alpha or beta carbon atom when R_1 is alkyl or cycloalkyl, this condition to be satisfied, in the case of cyclic groups, when the carbon atom alpha or beta to the N atom is part of the cycle;

R_1 and R_2, when taken together, represent a straight or branched chain alkylene group forming with the N atom to which they are attached a 5—10 membered heterocycle;

R_1 and R_2 when separate groups and when taken together provide a total of at least 5 carbon atoms; and

X represents R_3CO—, R_4SO_2— or R_5R_6NCO—,

where:

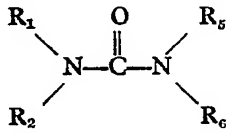
R_3 is H, C_1—C_6 alkyl, C_3—C_6 cycloalkyl, C_2—C_8 hydroxyalkyl, C_2—C_8 carboxyalkyl or C_3—C_8 alkylcarboxyalkyl, with the proviso that when R_3 is C_6 alkyl it is primary in structure;

R_4 is C_1—C_6 alkyl or C_8—C_6 cycloalkyl, with the proviso that when R_4 is C_5 or C_6 alkyl it is primary in structure;

R_5 and R_6, when taken separately, are each H, C_1—C_6 alkyl, C_3—C_6 alkylcycloalkyl, cycloalkyl, or cycloalkylalkyl, C_2—C_8 hydroxyalkyl, C_2—C_8 carboxyalkyl or

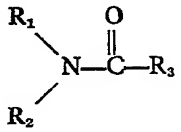
C_3—C_8 alkylcarboxyalkyl; or together represent a straight or branched chain C_3—C_{10} alkylene group optionally containing an ether oxygen atom; and
where:
R_1, R_2 and X provide a total of from 7—16 carbon atoms.

2. A product according to claim 1, wherein said compound is of the formula:

II 

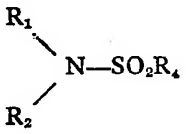
where R_1 is H or C_1—C_7 alkyl; R_2 is C_3—C_8 alkyl or C_3—C_8 cycloalkyl, cycloalkylalkyl or alkylcycloalkyl, R_2 having branching in an alpha position relative to the N atom when R_1 is H, or at an alpha or beta position when R_1 is alkyl, or where R_1 and R_2 are joined to form an alkylene group having up to 10 carbon atoms and having branching at an alpha or beta position relative to the N atoms, and forming together with the nitrogen atom a 5- to 7-membered ring; R_5 is H or C_1—C_6 alkyl, and R_6 is C_1—C_6 alkyl or C_3—C_6 cycloalkyl, or where R_5 and R_6 jointly represent an alkylene group, optionally containing an ether oxygen atom and forming with the N atom a 5- or 6-membered ring.

3. A product according to claim 1, wherein said compound is of the formula:



where R_1 and R_2 are as defined in claim 2 and R_3 is H, C_1—C_6 alkyl, C_2—C_6 hydroxyalkyl, carboxyalkyl or alkylcarboxyalkyl or C_3—C_6 cycloalkyl.

4. A product according to claim 1 wherein said compound is of the formula:



where R_1 and R_2 are as defined in claim 2 and R_4 is C_1—C_4 alkyl.

5. A product according to claim 1, which is a personal care product into which there is incorporated an effective amount of said cold receptor stimulating compound.

6. A product according to claim 1, which is a dentifrice into which there is incorporated an effective amount of said cold receptor stimulating compound.

7. A product according to claim 1, which is a toilet lotion comprising a liquid vehicle selected from the following: water, alcohol and mixtures thereof, and an adjuvant selected from the following: antiseptics, perfuming agents, colourants and mixtures thereof, and into which there is incorporated an effective amount of said cold receptor stimulating compound.

8. A product according to claim 1, which is a cosmetic preparation comprising an oil-in-water emulsion and an adjuvant selected from the following: antiseptics, perfuming agents, colourants and mixtures thereof, and into which there is incorporated an effective amount of said cold receptor stimulating compound.

9. A product according to claim 1, which is a toilet soap, into which there is incorporated an effective amount of said cold receptor stimulating compound.

10. A product according to claim 1, which is a shaving soap, foam or cream into which there is incorporated an effective amount of said cold receptor stimulating compound.

11. A product according to claim 1, which is a cleansing tissue impregnated with a cleansing liquid and into which there is incorporated an effective amount of said cold receptor stimulating compound.

12. A product according to claim 1, which is a toothpick coated or impregnated with an effective amount of said cold receptor stimulating compound.

13. A product according to claim 1, which is an edible preparation comprising an edible base, and an adjuvant selected from flavourants and colourants and mixtures

thereof, and into which there is incorporated an effective amount of said cold receptor stimulating compound.

14. A product according to claim 1, which is a chewing gum into which there is incorporated an effective amount of said cold receptor stimulating compound.

15. A product according to claim 1, which is a potable preparation comprising a potable base, and an adjuvant selected from flavourants and colourants and mixtures thereof and into which there is incorporated an effective amount of said cold receptor stimulating compound.

16. A product according to claim 1, which is a pharmaceutical preparation comprising a pharmaceutically acceptable carrier and a pharmaceutically active ingredient and into which there is incorporated an effective amount of said cold receptor stimulating compound.

17. A method of imparting to a consumer product for application to or consumption by the human body the property of stimulating the cold receptors of the nervous system of the human body, which comprises incorporating into the consumer product an effective amount of a compound of the formula defined in claim 1.

18. A method of stimulating the cold receptors of the nervous system of the human body which comprises applying thereto an effective amount of a compound of the formula defined in claim 1.

19. A tobacco or tobacco-containing manufacture comprising tobacco and an agent capable of stimulating the cold receptors of the nervous system of the nasal or oral mucosa when brought into contact therewith upon use of the manufacture, wherein said agent comprises an effective amount of a cold receptor stimulating compound of the formula defined in claim 1.

20. Tobacco impregnated with an amount of a cold receptor stimulant effective to stimulate the cold receptors of the nervous system of the oral or nasal mucosa when said tobacco, or the smoke therefrom, is in contact therewith, wherein said stimulant is a cold receptor stimulating compound of the formula defined in claim 1.

21. A cigarette containing an amount of a cold receptor stimulant effective to stimulate the cold receptors of the nervous system of the oral or nasal mucosa when the cigarette is smoked, wherein said stimulant is a cold receptor stimulating compound of the formula defined in claim 1.

22. A filter-tipped cigarette comprising a filter tip, a tobacco-containing body, and an amount of a cold receptor stimulant effective to stimulate the cold receptors of the nervous system of the oral or nasal mucosa when the cigarette is smoked, wherein said stimulant is a cold receptor stimulating compound of the formula defined in claim 1, which is impregnated in said filter tip.

23. A product according to claim 1, being a composition substantially as hereinbefore described in any one of the Examples.

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Printed for Her Majesty's Stationery Office by the Courier Press, Leamington Spa, 1977.
Published by the Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.